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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/796,437	03/09/2004	Jung-hun Seo	5649-1265	1822

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EXAMINER
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NOVACEK, CHRISTY L

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 09/08/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/796,437	<b>Applicant(s)</b> SEO ET AL.	
	<b>Examiner</b> Christy L. Novacek	<b>Art Unit</b> 2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 16 June 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-38 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-38 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

This office action is in response to the request for reconsideration filed June 16, 2006.

#### ***Claim Rejections - 35 USC § 102***

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1-4, 7, 9-30, 32 and 36-38 are rejected under 35 U.S.C. 102(e) as being anticipated by Saitoh et al. (US 6,838,772, previously cited).

Regarding claim 1, Saitoh discloses providing a substrate, forming a lower conductive pattern (18a), forming a barrier metal layer (17b1), flushing the barrier metal layer with a gas that includes a halogen group gas and forming an upper conductive layer (18b) on the barrier metal layer (Fig. 11-14; col. 19, ln. 34 – col. 22, ln. 50).

Regarding claim 2, Saitoh discloses that the gas includes a transition metal.

Regarding claim 3, Saitoh discloses that the gas includes argon.

Regarding claims 4 and 32, Saitoh discloses that the barrier metal layer is flushed at a temperature of 250-700°C.

Regarding claims 7 and 15, Saitoh discloses degassing the barrier metal layer using an argon gas to clean the metal layer.

Regarding claims 9, 10 and 17, Saitoh discloses that three separate barrier layers can be formed on the lower conductive pattern before forming the upper conductive layer.

Regarding claim 11, Saitoh discloses that any of the barrier layers can be deposited by sputtering.

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Regarding claims 12, 19, 25 and 37, Saitoh discloses that the barrier metal layers can be made of TiN, TiSiN, TaSiN and/or TaN.

Regarding claim 13, Saitoh discloses that any of the barrier layers can be deposited by atomic layer deposition (ALD).

Regarding claims 14 and 38, Saitoh discloses that the formation of the barrier layer by ALD and the flushing of the barrier layer can be performed multiple times.

Regarding claim 16, Saitoh discloses that the formation of the barrier layer by ALD, the flushing of the barrier layer and the degassing can be performed multiple times.

Regarding claim 18, Saitoh discloses that the lower conductive pattern can include copper.

Regarding claim 20, Saitoh discloses that the barrier layer can be deposited using chemical vapor deposition (CVD) with a metal organic precursor.

Regarding claim 21, Saitoh discloses that the upper conductive layer can include copper.

Regarding claims 22 and 29, Saitoh discloses treating the barrier metal layer with plasma before flushing the barrier metal layer.

Regarding claims 23 and 30, Saitoh discloses that the plasma includes hydrogen and nitrogen.

Regarding claim 24, Saitoh discloses forming a lower conductive pattern (18a) on a semiconductor substrate, forming a barrier metal layer (17b1), flushing the barrier metal layer with a gas that includes a halogen group gas and forming an upper conductive layer (18b) on the barrier metal layer (Fig. 11-14; col. 19, ln. 34 – col. 22, ln. 50). Saitoh discloses that the barrier

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layer can be deposited using a metal organic precursor and the barrier layer can be flushed using a processing gas of  $\text{TiCl}_4$  and argon.

Regarding claim 26, Saitoh discloses that the metal organic precursor can be TDEAT or TDMAT.

Regarding claim 27, Saitoh discloses that the barrier layer can be formed using MOCVD or ALD.

Regarding claim 28, Saitoh discloses that the ALD process involves purging using  $\text{NH}_3$ .

Regarding claim 36, Saitoh discloses that three separate barrier layers can be formed on the lower conductive pattern before forming the upper conductive layer and any of the barrier layers can be formed using sputtering.

### ***Claim Rejections - 35 USC § 103***

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 5, 6, 8, 31 and 33-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Saitoh et al. (US 6,838,772).

Regarding claims 5, 6, 33 and 34, Saitoh discloses that the barrier metal layer is flushed with argon gas and  $\text{TiCl}_4$  gas at a temperature of 250-700°C but Saitoh does not disclose the flow rates of the gases or the pressure under which the barrier layer is flushed. At the time of the invention, it would have been obvious to one of ordinary skill in the art to use routine experimentation to determine optimal gas flow rates and pressures of the flushing gases of Saitoh because such variables of art recognized importance are subject to routine experimentation and

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discovery of an optimum value for such variables is obvious. See *In re Aller*, 105 USPQ 233 (CCPA 1955).

Regarding claims 8 and 31, Saitoh discloses that the barrier metal layer is degassed with argon (inert) gas at a temperature of 250-700°C but Saitoh does not disclose the pressure under which the barrier layer is degassed. At the time of the invention, it would have been obvious to one of ordinary skill in the art to use routine experimentation to determine an optimal pressure of the degassing step of Saitoh because such variables of art recognized importance are subject to routine experimentation and discovery of an optimum value for such variables is obvious. See *In re Aller*, 105 USPQ 233 (CCPA 1955).

Regarding claim 35, Saitoh discloses flushing the barrier metal layer Saitoh does not disclose the processing time of the flushing. At the time of the invention, it would have been obvious to one of ordinary skill in the art to use routine experimentation to determine an optimal processing time of the flushing step of Saitoh because such variables of art recognized importance are subject to routine experimentation and discovery of an optimum value for such variables is obvious. See *In re Aller*, 105 USPQ 233 (CCPA 1955).

### ***Response to Arguments***

Applicant's arguments filed June 16, 2006 have been fully considered but they are not persuasive.

Regarding the rejection of claims 1 and 24 as being anticipated by Saitoh, Applicant argues that Saitoh allegedly fails to disclose flushing the barrier metal layer with a gas that includes a halogen group gas. The term “flushing” has not been given any special meaning or definition by Applicant; therefore, the term “flushing” as recited in Applicant’s claims is given

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its ordinary meaning in the art and its broadest reasonable interpretation. Saitoh discloses forming a barrier metal layer 17b1 and subjecting the entire surface of the layer to a halogen group gas ( $\text{TiCl}_4$ ) (col. 19, ln. 34 – col. 22, ln. 50). By subjecting the surface of the barrier metal layer to a halogen group gas (submersing the barrier metal layer in the halogen group gas), Saitoh meets the limitation of “flushing” the barrier metal with a halogen group gas. Therefore, these rejections are maintained.

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christy L. Novacek whose telephone number is (571) 272-1839. The examiner can normally be reached on Monday-Thursday and alternate Fridays 7:30 - 5:00.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on (571) 272-2429. The fax phone number for the organization where this application or proceeding is assigned is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

CLN  
August 21, 2006

  
Zandra V. Smith  
Supervisory Patent Examiner  
28 Aug. 2006